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STUDIES IN THE GENUS HEVEA V

THE STATUS OF THE BINOMIAL HEVEA DISCOLOR

BY

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THE name *Hevea discolor* (Spruce ex Benth.) Muell.-Arg. appears throughout the literature of *Hevea*, but it is used in such a confused way that serious doubt still plagues its exact meaning.

Until rather recently, *Hevea discolor* has been accepted as a binomial representing a distinct specific concept. In 1858, Baillon (Etud. Euphorb. (1858) 326) accepted *Siphonia discolor* as a valid species. Mueller-Argoviensis (in D.C. Prodr. 15, pt. 2 (1866) 717; in Martius Fl. Bras. 11, pt. 2 (1874) 299) also considered it to be distinct, placing it near *Hevea Spruceana* (Benth.) Muell.-Arg., because of its having obtuse staminate buds. In 1908, Huber (in Bol. Mus. Goeldi 5 (1908) 247) indicated the extreme closeness of *Hevea discolor* to *H. Spruceana* and suggested that one day it might be necessary to unite it with *H. Spruceana* and *H. similis* Hemsley. He stated: [translation] ". . . that *H. discolor* does not differ in essential characters, excepting in the size of the flowers, from *H. Spruceana* is a fact which is seen more and more as our study of the two species progresses. I myself must confess that it is impossible to distinguish . . . specimens which can positively be referred to *H. discolor*, in spite of the fact that the leaves of many of our specimens agree much more with this species than they do with *H. Spruceana*, according to Mueller's description . . . It is true that the few opened flowers of these specimens [*Poeppig 2595*, *Spruce 1171*] are much smaller than the completely developed flowers of *Hevea Spruceana*, but it seems to me that this can be due to their not having finished their growth. In our specimens from the lower Japurá and Teffé, from the area of *Hevea discolor*, there is such a curious mixture of characters of *H. discolor*, *H. similis* and *H. Spruceana*, that I have not been able to attribute them to one or the other species without reservation. At any rate, it is certain that the seeds of *Hevea discolor* from the mouth of the Rio Negro . . . and of *H. similis* from the lower Japurá are so similar to those of *H. Spruceana* from Obidos that, if they should be mixed, they could not again be separated."

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In summary, Huber mentioned that *Hevea discolor* must be taken from the list of trees yielding good rubber and be placed amongst those of no commercial value, together with *H. Spruceana* and *H. similis*, with which concepts it may one day have to be united in one single species.

In his monograph of *Hevea*, Pax (in Engler's Pflanzenr. 4, 147 (1910)) retained *H. discolor* as a distinct species, placing *H. Spruceana*, *H. similis* and *H. discolor* together as species with obtuse staminate buds and a pilose under surface of the leaf. The only difference he noted between *Hevea discolor* and the other two concepts lay in the size of the staminate flowers.

Shortly thereafter, Huber (in Bol. Mus. Goeldi 7 (1913) 645–646, 650) accepted, apparently without hesitation, *Hevea discolor* as representing a distinct species, allied to and coinciding more or less in geographical distribution with *H. Spruceana* and *H. similis.*

The problem of the real meaning of *Hevea discolor* was left unattended until 1925, when Ducke (in Arch. Jard. Bot. Rio Janeiro 4 (1925) 111) stated that *H. discolor* Muell.-Arg. and *H. similis* Hemsley, both from the State of Amazonas, have the appearance, the low-quality latex and the common name of *H. Spruceana,* and are separated from this species only by a few characters of little importance in the leaves and flowers; he was convinced that it was a question of mere varieties, having found, even among the trees of *H. Spruceana* at Obidos, a strong variation in the size of the flowers.

Subsequently, in 1929, Ducke (in Rev. Bot. Appl. 9 (1929) 630) stated that *Hevea discolor* represents a form, not even a geographical variety. Nevertheless, he pointed out that in the upper Amazon there is a predominance of trees whose leaflets are strongly pilose and which correspond especially to *discolor;* whereas in the lower Amazon, the leaves are usually almost glabrous. Ducke further noted that sterile specimens of his *Hevea Spruceana* forma *discolor* can easily be confounded with *H. Benthamiana* Muell.-Arg., a fact which he believes is the basis of the confusion in the literature of the past, which attributed the best rubber of the Rio Negro (extracted from *H. Benthamiana*) to *H. discolor*. Later, he reiterated the same opinion (in Arch. Jard. Bot. Rio Janeiro 5 (1930) 156). Five years afterwards, in his monograph of the genus (in Arch. Instit. Biol. Veg. 2 (1935) 239), he definitely reduced the binomial *Hevea discolor* to synonymy under *H. Spruceana.* This treatment is retained in Ducke's most recent synopsis of *Hevea* (Bol. Técn. Instit. Agron. Norte no. 10 (1946) 20, 23).

Recently, Baldwin (in Journ. Hered. 40 (1949) 48) has intimated that the well known and firmly established binomial *Hevea Benthamiana* might have to be given up in favor of *H. discolor*. He stated: "*Hevea discolor* (Spruce ex Bentham) Muell.-Arg. was based on type material now usually referred in part to *H. Spruceana* (Benth.) Muell.-Arg. and in part to *H. Benthamiana* Muell.-Arg.; since *H. discolor* antedates the last name, *H. Benthamiana* would seem to be invalid."

This very problem has perturbed me for several years. In 1947, when I had an opportunity of studying abundant typical material of *Hevea* in various British herbaria, it appeared to me that the name *H. discolor* referred to a confused concept based upon two different species.

Notwithstanding the fact that the problem is fundamentally nomenclatorial and can be settled only by consultation with the literature and type specimens, I decided to let definitive studies of the question lie in abeyance pending a visit to and a sojourn in the type localities, during which a critical examination of many living individuals and the collection of ample topotypical material could be effectuated. This field work has been carried out, and the literature and type material have been studied again in the light of knowledge gained in the field. I am now convinced that, in accordance with the International Rules of Botanical Nomenclature, *Hevea discolor* may be rejected and that the well-established names, *H. Benthamiana* and *H. Spruceana*, may continue in an unaltered status.

A study of the status of *Hevea discolor* as a binomial necessitates a careful examination of Bentham's description and discussion (in Hooker's Kew Journ. Bot. 6 (1854) 369):

> *S. discolor*, Spruce, MC.; foliolis breviter petiolulatis discoloribus subtus pubescentibus, glandulis parvis, panicula tomentosa, pedicellis flore brevioribus, calycibus obtusis, antheris 7–10 duplici serie verti-

cillatis.— *S. brasiliensis*, H.B.K., Nov. Gen. et Sp. vol. vii, p. 170? vix Willd.— *Micrandra ternata*, R. Br. Pl. Jav. Rar. p. 237.

Common in the gapó of the Rio Negro and of its tributary the Rio Uaupés, and known by the name of *Seringue de gapó*. The tree scarcely exceeds 25 feet, but the branches spread out horizontally, sometimes to a considerable distance. The milk is sparing, and elastic when dry. The leaves are like those of *S. elastica*, but always more or less pubescent underneath, generally 4 or 5 inches long; the flowers of a reddish-purple. The anthers are small and ovate, in two distinct verticils, sometimes both complete, with five in each, but one or two are frequently wanting in the upper one, and occasionally one also of the lower one. Some specimens in fruit of Mr. Spruce's first Barra collection were distributed as belonging doubtfully to the *S. elastica*. I have referred here Mr. Brown's species, on account of the pubescence of the underside of the leaf.

Bentham did not cite any specimens in connection with the description of *Siphonia discolor*. However, we find preserved at Kew two of Spruce's collections which have been annotated, one apparently in Bentham's own hand, as representing *Siphonia discolor*. One of these collections (*Spruce 1171*) was made "ad oram septentrionalem flum. Amazonum, ad ostium Rio Negro" in August 1851 and represents the expression of *Hevea Spruceana* which is abundant in the vicinity of Manáos. The other (*Spruce 2560*) was collected "prope Panuré ad Rio Uaupés in the period from October 1852 to January 1853 and is the type of Mueller's *Hevea Benthamiana*. We are certain that these two collections entered into Bentham's consideration of *Hevea discolor*, for we know: (1) that *H. discolor* was based upon Spruce collections; (2) that Bentham's geographical data ("common in the gapó of the Rio Negro, and of its tributary the Rio Uaupés") correspond to the localities of *Spruce 1171* and *2560;* and (3) that there are no other contemporary collections annotated with the binomial under discussion.

Furthermore, in Spruce's field notebook, preserved at Kew, we find the following annotation against his collection *2560* which indicates that he himself considered these two collections as representing the same concept:

> *2560. Siphonia discolor* sp. n. gapó. Sm. milky tree 20 ft. Petioles 5½ in. Lts. 6⅛×3, subov.-ellipt. with abrubt subobt. apic. ven. wsh. and pubt. Pans. subpubt. Fl. very p. y. pubt., segm. acum. cf. Barra [Manáos] *Siphonia 1171.*

If we analyze, point for point, Bentham's description, we find that the leaflets, with their short petiolules, difference in color of the two surfaces, presence of hair on the under surface and small glands, possess characters which one finds to be common to the two concepts which *Spruce 1171* and *2560* represent. Indeed, vegetatively, and to a much lesser extent florally, ***Hevea Benthamiana*** often strikingly resembles ***H. Spruceana***, a similarity which doubtlessly underlay Spruce's as well as Bentham's confusion of the two concepts as one. The panicles are tomentose in both collections, albeit a distinct color difference may be noted; and the floral stalk in both is rather short. Bentham continues by stating "calycibus obtusis," probably meaning by the term "calycibus" *buds* or the *closed calyx*, in which case it is obvious that he is describing *Spruce 1171* and not *2560*, for in *2560*, the buds, as described by Mueller, are "longius acuminatis" and the calyx lobes "longe acuminatis." *Hevea discolor* was described as having from seven to ten anthers disposed in two whorls, a character which might refer either to ***H. Spruceana*** or to ***H. Benthamiana.***

Following the technical Latin description, Bentham's English discussion provides additional characters of importance. The mode of branching which is described can be seen in individuals of both ***Hevea Spruceana*** and ***H. Benthamiana***, but my experience leads me to associate it more frequently with the former than with the latter. The latex is said to yield an elastic rubber. This is an interesting comment, since it is impossible to obtain an elastic rubber from true *Hevea Spruceana*; yet the quality of the product of *H. Benthamiana* is usually only slightly inferior to (and frequently as high as) that of *H. brasiliensis*, the source of the best rubber. In ascribing to the flowers of *Hevea discolor* a "reddish purple" hue, Bentham is very definitely describing a character of *H. Spruceana; H. Benthamiana* is known to have bright lemon-yellow flowers. Judging from the amount and kind of variation which Bentham describes for the anthers of *Hevea discolor*, we might be moved to think more of *H. Benthamiana* than of *H. Spruceana*. Although some variation is found in the number and placement of the anthers in the latter species, there is very much less instability than is evident in the former.

Bentham considered *Siphonia Spruceana* and *S. pauciflora* directly following the description and discussion of *S. discolor*. Describing *Siphonia Spruceana* as a plant of the banks of the Amazon below Santarem, Bentham stated (l. c. 370) that it has "numerous flowers, purple withinside, and much larger than in *S. discolor*," but he made no definite statement that he considered it to be allied at all closely to *S. discolor*. On the contrary, and rather surprisingly, he wrote (l. c. 370) of *Siphonia pauciflora*, a species which Spruce collected in rocky situations along the Rio Uaupés: "This is certainly near to *S. discolor*, and may prove a mere variety."

Although it is clear that Bentham based his description of *Hevea discolor* on the two collections, it is plain that the greater weight in both the English and the Latin description is given to *Spruce 1171* which represents *H. Spruceana*. I, therefore, typify *Hevea discolor* by choosing *Spruce 1171* as the lectotype of this concept.

We may then treat the binomial *Hevea discolor*, as Ducke definitely has done (in Arch. Jard. Bot. Rio

Janeiro 5 (1930) 156 and in Bol. Técn. Instit. Agron. Norte no. 10 (1946) 20, 23), as a synonym of ***H.*** *Spruceana.* The fact that ***Hevea** discolor* has page priority over ***H.*** *Spruceana* is of no significance, since Ducke, in 1930, first combined them under the latter binomial. Thus, this name, which has caused so much confusion and uncertainty, henceforth need not be a source of worry to students of the genus of the Pará rubber tree.

STUDIES IN THE GENUS HEVEA VI

NOTES, CHIEFLY NOMENCLATURAL, ON THE HEVEA PAUCIFLORA COMPLEX

BY

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There has long been confusion and uncertainty in the taxonomic and nomenclatural aspects of the study of the several concepts known as *Hevea Kunthiana*, *H. pauciflora*, and *H. confusa*. Recent studies in the field and in the herbarium have contributed much towards a clarification of some of the difficulties, but a more thorough understanding of the representatives of this complex, especially of those in British Guiana, would seem to be desirable. When further field work has been accomplished, I hope to present a detailed taxonomic study; but the need for an understanding of the proper names to use in this group is so urgent as to recommend the publication of our present knowledge of the nomenclatural aspects of the problem without further delay.

Hevea pauciflora (*Spruce ex Benth.*) *Mueller-Argoviensis* in Linnaea 34 (1865) 203.

Siphonia brasiliensis Humboldt, Bonpland & Kunth Nov. Gen. et Sp. 7 (1825) 171.

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Siphonia pauciflora Spruce ex Bentham in Hooker Kew Journ. 6 (1854) 370.

Siphonia Kunthiana Baillon Étude Gén. Euphorb. (1858) 326.

Hevea brasiliensis (HBK.) Mueller-Argoviensis in Linnaea 34 (1865) 204, *pro parte.*

Hevea pauciflora (Spruce ex Benth.) Mueller-Argoviensis * [forma?] *membranacea* Mueller-Argoviensis in DC. Prodr. 15, pt. 2 (1866) 718.

Hevea membranacea Mueller-Argoviensis in Martius Fl. Bras. 11, pt. 2 (1874) 299.

Hevea Kunthiana (Baill.) Huber in Bol. Mus. Para. 3 (1902) 349.

Hevea membranacea Mueller-Argoviensis var. *leiogyne* Ducke in Arch. Jard. Bot. Rio Janeiro 6 (1933) 57.

Hevea pauciflora (Spruce ex Benth.) Mueller-Argoviensis ssp. *typica* Ducke in Arch. Inst. Biol. Veg. Rio Janeiro 2 (1935) 239.

Hevea membranacea Mueller-Argoviensis forma *leiogyne* Ducke l. c. 239.

Hevea pauciflora (Spruce ex Benth.) Mueller-Argoviensis forma *tipica* Ducke in Bol. Técn. Inst. Agron. Norte 10 (1946) 17.

Hevea pauciflora (Spruce ex Benth.) Mueller-Argoviensis forma *leiogyne* (Ducke) Ducke l. c. 17.

For some time now it has seemed to me that one specific concept is involved in the two binomials, *Hevea pauciflora* and *H. Kunthiana.* Study of the type of *Siphonia Kunthiana* in the Paris Herbarium in 1950 has convinced me that this suspicion was well founded. A critical examination of the type collection, a unicate represented only in Paris, was necessary before coming to a definite conclusion, because the type of *Hevea Kunthiana* is completely sterile, and the description alone affords few definite characters. A brief survey of the history of these two binomials may help to clarify my reasons for relegating *Hevea Kunthiana* to synonymy under *H. pauciflora.*

In 1858, Baillon (l. c. 326) pointed out that *Siphonia brasiliensis* K., based upon the collection *Bonpland 5022*, was not the same concept as *S. brasiliensis* Willd. He proposed a new name for the Kunth concept, publishing it as follows: "*S. Kunthiana* + = *S. brasiliensis* K. non W. (Coll. Bonpland, n. 5022)." In accordance with Article 44 of the International Rules of Botanical Nomenclature, we must consider this as a validly published name, for "the name of a species . . . is not validly published unless it is accompanied . . . by the citation of a previously and effectively published description of the group . . . ." Although Baillon did not refer to the Kunth description by the work and the page where it was published, there can be no doubt that his citing of Kunth as authority constitutes a citation of the actual description (Humboldt, Bonpland & Kunth Nov. Gen. et Sp. 7 (1825) 171).

The specimen upon which the Kunth description was based and which Baillon cites in his substitution of "*Siphonia Kunthiana*" for "*S. brasiliensis* K." was collected in the upper reaches of the Orinoco in Venezuela and represents the same concept which was later collected by Spruce in the neighboring regions of the upper Rio Negro basin of Brazil and described as *Siphonia pauciflora.* This binomial and, more recently, *Hevea pauciflora* have gained wide acceptance, whereas *H. Kunthiana* has been largely ignored (Ducke in Arch. Inst. Biol. Veg. Rio Janeiro 2 (1935) 217), or relegated to synonymy with reserve under *H. brasiliensis* (Seibert in Ann. Mo. Bot. Gard. 34 (1947) 306). Ule (in Engler Bot. Jahrb. 35 (1905) 665) considered *Siphonia Kunthiana* a *nomen nudum,* and Pax (in Engler Pflanzenr. IV, 147 (1910)

128) followed him in this rejection of the name.

It is curious that Baillon failed to mention *Siphonia Kunthiana* in an article (in Adansonia 4 (1863–64) 284) which he published somewhat later than his proposal of the new binomial. This omission may possibly be attributed to the fact that the article in question dealt with the American *Euphorbiaceae* of eastern South America ("Brésil, Uruguay, Paraguay, Patagonia, etc.") and may not have been meant to include material from the Orinoco. Therefore, I do not believe that the omission has any real significance, especially since other species of *Hevea* (e.g. *Hevea guianensis* Aubl.) were likewise not included.

In 1865, Mueller-Argoviensis (in Linnaea 34 (1865) 204), when making the combination *Hevea brasiliensis*, considered *Siphonia Kunthiana* as a synonym of Kunth's *S. brasiliensis.*

In considering the problem of the real meaning of the binomial *Hevea brasiliensis*, Huber concluded (in Bol. Mus. Para. 3 (1902) 349; in Rev. Cult. Col. 10 (1902) 99; in Bull. Soc. Bot. France 49 (1902) 45) that the Orinoco material which Kunth had described as *Siphonia brasiliensis* should be called *Hevea Kunthiana*, and he accordingly made the indicated new combination from *Siphonia.*

Pointing out that the specimens which Kunth described as *Siphonia brasiliensis* were not referable to Willdenow's *S. brasiliensis*, Chevalier (in Rev. Bot. Appl. 16 (1936) 621) stated that their identity was still uncertain. He admitted the possibility that they may be referable to another Brazilian species already described, but he decided that, pending further material in flower and fruit from the original localities, it would be advisable to call it *Hevea Kunthiana* provisionally. Apparently unaware that Huber had made the combination in 1902, Chevalier remade it. In a further discussion of the problem of the sterile Bonpland collection, Chevalier (l.c. 622) reported that it is very similar to *Spruce 2691*, the specimen upon which *Hevea pauciflora* and *H. membranacea* were based. The Paris material of *Spruce 2691* was annotated "*Hevea pauciflora* Muell.-Arg. ?" by Hemsley and "*H. brasiliensis* Muell.-Arg." by Poisson. Chevalier inclined to the belief that Hemsley's opinion was correct, but he decided to conserve the name *Hevea Kunthiana.*

In 1906, Huber (in Bol. Mus. Para. 4 (1906) 622) did not feel certain enough to assign a position to *Hevea Kunthiana* in his scheme of the genus. He placed *Hevea Kunthiana* in his Series *Obtusiflorae* under "Incertae sedis" together with *H. nitida* and *H. viridis*, both of which were, like *H. Kunthiana*, based on sterile material. He further stated (l. c. 648) that *Hevea Kunthiana* was a very poorly known species in spite of the fact that it seemed to him to be a source of rubber, but that it was certainly different from *H. Benthamiana* of the same area. In 1913, Ule (in Engler Bot. Jahrb. 50, Beibl. 114 (1913) 17), who had previously dismissed *Siphonia Kunthiana* as a *nomen nudum*, employed the binomial *Hevea Kunthiana* in an enumeration of species found in the northern Amazon.

Most recently, Baldwin has discussed the application of the binomial *Hevea Kunthiana.* In 1947, he wrote (in Journ. Hered. 38 (1947) 55) that "specimens collected on the Orinoco by Aimé Bonpland and early confused with *H. brasiliensis* are possibly correctly referred to *H. pauciflora,*" in accord with Chevalier's suggestion. Two years later, he definitely accepted this suggestion (in Journ. Hered. 40 (1949) 48); he took up *H. Kunthiana* "for the Orinoco plant, for the '*seringa da serra*' of the upper Rio Negro, and for certain collections from British Guiana and Surinam."

Before leaving our discussion of *Hevea Kunthiana*, we should consider the history of the binomial *H. membranacea* and of the various other combinations in which the epithet *membranacea* has been used. *Hevea membranacea* as a name has no biological significance whatsoever, for Mueller described the concept from the same collection (*Spruce 2691*) that was already the type of *H. pauciflora.* The epithet *membranacea* has, however, persisted in the literature and has been bandied about in the nomenclature to such an extent that much uncertainty might easily be experienced by rubber investigators who are not familiar with all of the intricacies of the problem.

The first published mention of the epithet *membranacea* was made apparently in 1866, when Mueller-Argoviensis (in DC. Prodr. 15, pt. 2 (1866) 718 wrote the following:

> Ludit * *membranacea*, foliolis tenuiter membranaceis. [tree]. In Guyana anglica cum forma genuina speciei (Rich. Schomb. in hb. berol!). Haec praeter consistentiam foliorum nullo modo recedit.

It is not clear just what Mueller meant by the use of the asterisk, but it is important to attempt to clarify his meaning, if possible. This sign is not included in the enumeration of signs at the beginning of volume 15 of the Prodromus, so it must have been used in a sense which, at the time, was widely understood. Mueller might have employed the asterisk to mean subspecies or variety, for it was often used during the 19th century to designate subspecific variants, especially subspecies. Persoon (Syn. Plant. 1 (1805)) was apparently the first to use it in this way. An example may be cited (l. c. 2 (1807) 41):

> *Mesembryanthemum* 4. *linguiforme α scalpratum* Obs. Tres. sequentes tantummodo subspecies videntur: * *latum*, * *obliquum*, * *longum*.

Each of these subspecies is described. Another example from later in the century is that used by C. F. Nyman (Consp. Fl. Europ. 1 (1878) pg. ant. pg. 1):

> Signa demum sunt explicanda, quibus subspecies, varietas, etc. indicandas utimur. Subspecies ideo (litteris minimis impressae) notantur asterisco (*), . . .

Nevertheless, the asterisk was also frequently employed to signify a subspecific variant of doubtful worth or the exact rank of which was uncertain. Persoon (Syn. Plant. 1 (1805) x) used it thus:

> Speciebus obscuris, aut quoad sedum accuratori indagationi subjiciendis, signa crucis seu asteriscum apposui.

I believe that it is in this sense that Mueller used the asterisk, for we find a clear example of this use in Mueller's own writing (in DC. Prodr. 15, pt. 2 (1866) 749) under *Crozophora tinctoria β Hierosolymitana:*

> Haec ludit * *brachypetala*, petalis florum foemineorum calyce paulo v. duplo imo 4-plo brevioribus.

In this case, we might call the variant a *forma* today; Mueller usually employed Greek letters for *varietas*, so that it is probable that he thought of the asterisk in this particular instance as a subvarietal variant or *forma*. This indirect evidence, coupled with his statement that the variant of *Hevea pauciflora* which he was calling *membranacea* "praeter consistentiam foliolorum nullo modo recedit" from the species, convinces me that the epithet *membranacea* was first published as a *forma*.

In his description of *Hevea pauciflora* forma *membranacea*, quoted above, Mueller based the concept on a collection made by Richard Schomburgk and preserved in the Berlin Herbarium. Then, a few years later (in Martius Fl. Bras. 11, pt. 2 (1874) 299) he raised the concept to specific rank under the name *Hevea membranacea*, giving a much fuller description. In so doing, he cited *Spruce 2691* as the only collection referable to *Hevea membranacea; Spruce 2691* was already the type of *H. pauciflora!* He failed to enumerate the Schomburgk specimen under *Hevea membranacea*, but included it under *H. pauciflora*, referring to *H. membranacea* as "bene distincta." He does not distinguish *Hevea membranacea* from *H. pauciflora* directly, but from groups of other species, and he fails to refer back to his 1866 publication of the epithet *membranacea.*

It appears that Huber (in Bol. Mus. Para. 2 (1897) 252) accepted *Hevea membranacea* as a good species, for he enumerated it amongst species which "probably" were used in the production of rubber. In 1906, however, Huber (in Bol. Mus. Para. 4 (1906) 620) apparently made no mention of *Hevea membranacea* in his synopsis of the genus. Ule (in Engler Bot. Jahrb. 50, Beibl. 114 (1913) 17) likewise listed *Hevea membranacea* as one of the species of the northern part of the Amazon. In 1910, Pax (in Engler Pflanzenr. IV, 147 (1910) 126) kept up *Hevea membranacea* as distinct from *H. pauciflora*, separating it from *H. pauciflora* in his key (l. c. 120) on only one character — the membranaceous consistency of the leaflets, but carefully pointing out (l. c. 118) through what limited material this concept was known.

In 1929, Ducke (in Rev. Bot. Appl. 9 (1929) 629; in Arch. Jard. Bot. Rio Janeiro 5 (1930) 156) listed *Hevea membranacea* as occurring in British Guiana and the northwestern part of the Estado do Amazonas in Brazil. Shortly thereafter, he employed this binomial (in Arch. Jard. Bot. Rio Janeiro 6 (1933) 56) to designate trees growing on granitic soil at São Paulo de Olivença on the Rio Solimões and along the Rio Uaupés. He also described (l. c. 57) the variety *leiogyne*, differing primarily in a minor character of the pistillate flower. In 1935, Ducke (in Arch. Inst. Biol. Veg. Rio Janeiro 2 (1935) 239) reduced this variety to a form. In 1946, he reduced *Hevea membranacea* to synonymy under *H. pauciflora* (in Bol. Técn. Inst. Agron. Norte no. 10 (1946) 24) and transferred forma *leiogyne* from *H. membranacea* to *H. pauciflora.*

Seibert (l. c. 300) reduced to synonymy under *Hevea pauciflora* not only *H. membranacea*, but also all of the several trinomials referring to the concept which Ducke has variously designated by the epithet *leiogyne.* A study of representative material both in the field (in the type locality) and in the herbarium convinces me that the distinguishing character given for the *leiogyne* concept is not sufficiently stable to warrant the creation of a distinct taxonomic entity.

Hevea pauciflora (*Spruce ex Benth.*) *Mueller-Argoviensis* var. **coriacea** *Ducke* in Arch. Inst. Biol. Veg. Rio Janeiro 2 (1935) 239.

Hevea confusa Hemsley in Hooker Icones Plant. 26 (1898) 2, t. 2570; t. 2575, figs. 1–3, 12–13.

Hevea minor Hemsley l. c. 26 (1898) t. 2572.

? Hevea camporum Ducke in Arch. Jard. Bot. Rio Janeiro 4 (1925) 111.

Hevea humilior Ducke in Rev. Bot. Appl. Agric. Trop. 9 (1929) 624, 629, t. 18.

Hevea pauciflora (Spruce ex Benth.) Mueller-Argoviensis ssp. *coriacea* Ducke in Arch. Inst. Biol. Veg. Rio Janeiro 2 (1935) 239.

When Ducke described this subspecific variant of *Hevea pauciflora*, he pointed out that it "differs from *pauciflora* typica by the smaller size of all its parts, and by the thicker adult leaves which are rigidly membranaceous or (in the caatinga-vegetation of the upper Rio Negro) hardly coriaceous" [undoubtedly meaning "hard-coriaceous"]. Since its description by Ducke, this concept has been found to be relatively widespread and has commanded an appreciable amount of attention; the trinomial has been used in the literature (Schultes in Bot.

Mus. Leafl. Harvard Univ. 12 (1945) 10; ibid. 13 (1948) 117).

On a specimen of the collection *Richard Schomburgk 1381* preserved in the Paris Herbarium, there is an annotation of an unpublished binomial, under *Siphonia*, honoring the collector. The date and authorship of this annotation are unknown, but it represents apparently the earliest recognition of the concept as distinct from typical *Hevea pauciflora.*

In 1898, Hemsley described, after much study and hesitation, certain coriaceous-leaved specimens from British Guiana as *Hevea confusa.* Several of these collections (*Robert Schomburgk 817, Richard Schomburgk 1381*) had been cited by Mueller-Argoviensis (in Linnaea 34 (1865) 203; in DC. Prodr. 15, pt. 2 (1866) 717; in Martius Fl. Bras. 11, pt. 2 (1874) 300) as representing *Hevea pauciflora*, along with the type of this species (*Spruce 2691*); and Bentham himself considered these specimens to represent the same concept as the Spruce collection, for, in discussing *H. pauciflora*, he wrote that "apparently the same species is found also in British Guiana (Parker, and also Hancock in herb. Hook.–Robt. Schomburgk, 2nd coll. n. 817, Rich. Schomb. n. 1381)." I have spoken with botanists at Kew who conferred with Hemsley at the time he decided to publish *Hevea confusa* and have learned that he was not at all certain that he was dealing with a variant of specific rank. This is brought out in a report of a talk by Hemsley at the Linnean Society of London on April 4, 1901 (Journ. Bot. 39 (1901) 189: "It was formerly supposed that two species of *Hevea* might be distinguished in British Guiana, one (*Hevea pauciflora*) having thin leaves and a hairy ovary, the other thick, coriaceous leaves and a glabrous ovary, but, after examining a large number of specimens, Mr. Hemsley had come to the conclusion that the differences were not constant, and that all the specimens exhibited might belong to one species and merely represented individual variation." This, incidentally, does not constitute a reduction by Hemsley of *Hevea confusa*, as Ducke (in Bol. Técn. Inst. Agron. Norte no. 10 (1946) 18) and Seibert (l. c. 301) have intimated; but it does indicate that Hemsley was uncertain. Uncertainty still persists. That the majority of the British Guiana specimens are different from typical *Hevea pauciflora* cannot be denied, but whether the difference is of a specific, varietal, or formal nature is the question.

In 1947, Seibert (l. c. 300) reduced *Hevea pauciflora* var. *coriacea* to synonymy under *H. pauciflora*, stating (l. c. 301): "The [*Hevea pauciflora*] complex has gone through various phases of taxonomic splitting, in which the Guiana material is usually considered as *H. confusa*. The Brasilian material from the Rio Negro and Solimões is referred to *H. pauciflora*, with coriaceous-leaved specimens as *H. pauciflora* var. *coriacea*. Although Hemsley described *H. confusa* as distinct from *H. pauciflora*, he later (1901) came to the conclusion that it was synonymous with the latter. More recently the feeling has been that *H. confusa* is synonymous with *H. pauciflora* var. *coriacea*."

Seibert stands alone in lumping together the coriaceous-leaved British-Guianan concept with the finer-leaved concept so common along the Rio Negro. He has pointed out (in Ann. Mo. Bot. Gard. 35 (1948) 120) that *Hevea pauciflora* is highly variable. It is true that there is a high degree of variability within this species over its widespread and disrupted range, but the two concepts in question are definitely distinct. This distinctness, recognized first in herbarium material by Hemsley, has been appreciated in the field by Ducke, Baldwin, and Schultes.

EXPLANATION OF THE ILLUSTRATIONS

PLATE LXXVII. HEVEA PAUCIFLORA (*Spruce ex Benth.*) *Muell.-Arg.* var. CORIACEA *Ducke* on the outskirts of Iquitos, Peru. This colony of trees appears to be that from which the type of HEVEA HUMILIOR *Ducke* was collected.

Photographs by RICHARD EVANS SCHULTES. *Courtesy of the Missouri Botanical Garden.*

In the upper Rio Negro, Baldwin (in Journ. Hered. 38 (1947) 57) noted the differences between the "seringa da serra" and the "seringa da caatinga," pointing out that "at São Gabriel on the Rio Negro one finds intergrades of the two": the former he called *Hevea pauciflora*, the latter *H. confusa*, thus intimating that the greater part of the British Guiana material and the "seringa da caatinga" of the Rio Negro belong to the same concept. He has continued to hold this opinion in later publications (Baldwin and Schultes in Bot. Mus. Leafl. Harvard Univ. 12 (1947) 335).

After having spent a year in the upper Rio Negro valley and having studied material in American and European herbaria, I am of the opinion that: (1) the British Guiana material which Hemsley called *Hevea confusa* is, with some variability, the same concept as the "serra da caatinga" of the upper Rio Negro; that (2) these are varietally distinct from typical *Hevea pauciflora* known principally from rocky situations along the uppermost reaches of the Rios Negro and Orinoco; and that (3) they represent the same concept described by Ducke as *Hevea pauciflora* var. *coriacea*. While a full biological study of the *Hevea pauciflora* complex should await still further field studies, an examination of the available herbarium material brings into evidence the fact that differences do exist. Nevertheless, I have not found sufficient differences in floral or fruiting structures to warrant a specific rank. In 1948 (in Bot. Mus. Leafl. Harvard Univ. 13 (1948) 117), I argued for the maintenance of a varietal rank pending further field studies. Ducke (in Bol. Técn. Inst. Agron. Norte no. 10 (1946) 18, 23) likewise has indicated his belief that the British Guiana material should be maintained as a variety, stating, however, that he was in doubt as to whether *Hevea confusa* should be kept up as a distinct variety of *Hevea pauci-*

flora or incorporated with ***H.*** *pauciflora* var. *coriacea.*

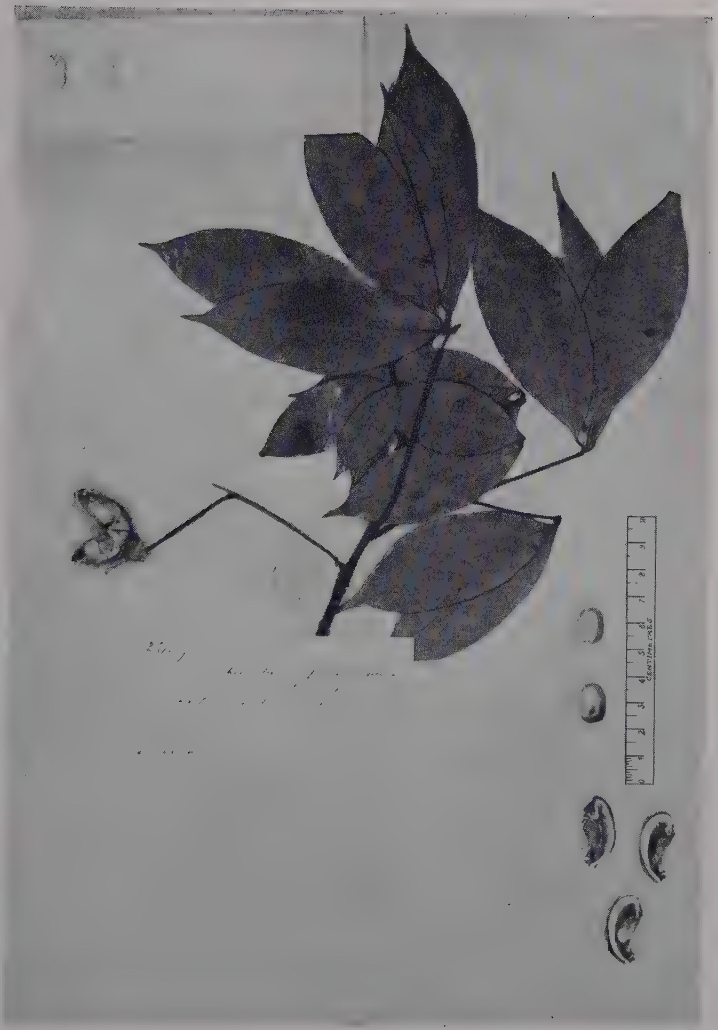
For many years, there has been some uncertainty as to just what the concept which Hemsley called ***Hevea*** *minor* represented. This species was based on a single specimen from the Río Casiquiare in southern Venezuela, preserved in the Kew Herbarium. During the greater part of the present century, the erroneous belief that ***Hevea*** *minor* and ***H.*** *microphylla* Ule were identical was accepted. A recent study (Schultes in Bot. Mus. Leafl. Harvard Univ. 13 (1947) 1) of type and authentic material has shown that ***Hevea*** *microphylla* is indeed distinct from ***H.*** *minor.* There still remained some doubt, however, as to whether or not ***Hevea*** *minor* represented a distinct species or a variant of some described concept. The paucity and apparent immaturity of the type and only specimen of ***H.*** *minor* made it unwise to conjecture. During the work in the upper Rio Negro basin in 1947 and 1948, I collected flowering and fruiting specimens from a number of caatinga-trees which are almost exact matches for the type of ***Hevea*** *minor.* One of these collections (*Schultes & López 9489*) came from a small tree at Cocuy, not far from the mouth of the Casiquiare and may, therefore, be considered almost topotypical; it is one of the collections most closely resembling *Spruce 3457*, the type of ***Hevea*** *minor.* I was unable to penetrate the Casiquiare itself, but many natives informed me that the riverside caatingas of the Casiquiare abound with this small rubber tree. It is found in abundance in most caatingas in the Rios Curicuriarí and the Uaupés, and upstream in the Rios Negro and Guainía. There is considerable variability in size of the trees, those growing in low-lying sandy caatingas which are flooded part of the year being extremely small, seldom exceeding fifteen feet in height.

The type of ***Hevea*** *minor* was in fruit and with seed.

EXPLANATION OF THE ILLUSTRATION

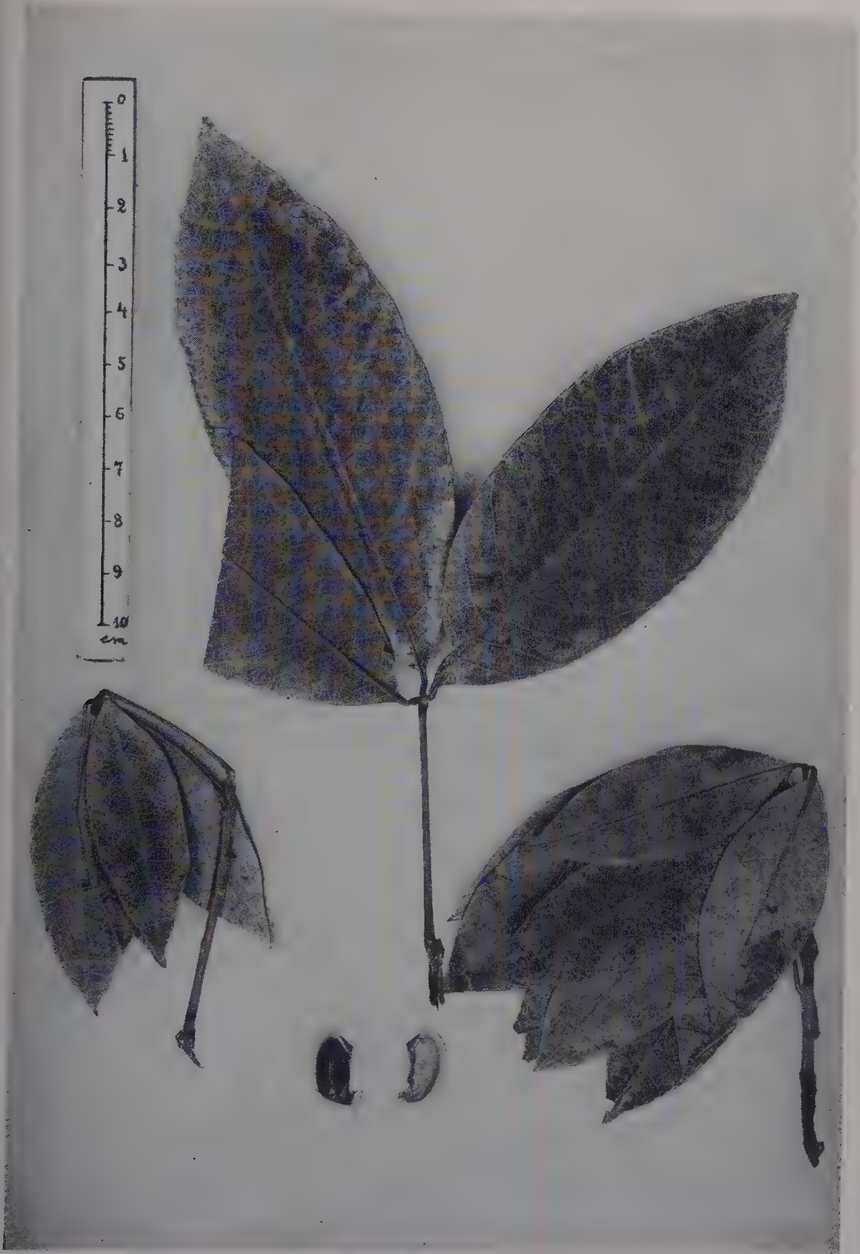
Plate LXXVIII. Photograph of the type specimen of *Hevea minor* Hemsl., preserved in the Kew Herbarium.

Plate LXXVIII



EXPLANATION OF THE ILLUSTRATION

Plate LXXIX. Photograph of the type specimen of *Hevea camporum* Ducke, preserved in the herbarium of the Jardim Botânico de Rio de Janeiro.


0
1
2
3
4
5
6
7
8
9
10
cm

During my work in the Rio Negro, it was possible to make both flowering and fruiting collections from the same individual in several instances. This enabled me to identify the material I collected with *Hevea pauciflora* var. *coriacea* by means of the flowers on the one hand, and with *H. minor* by means of the seeds on the other. Consequently, there can be no doubt that *Hevea minor* is the same as *H. pauciflora* var. *coriacea.* This has been suspected for some time (Schultes in Bot. Mus. Leafl. Harvard Univ. 15 (1952) 111), but now the former name must definitely be placed in synonymy under the latter. Because of the International Rules of Botanical Nomenclature requiring the use of the earliest name under the rank maintained, it is impossible to use the earlier epithet *minor* as the varietal designation.

In 1925, Ducke introduced to science one of the most unusual concepts in the genus when he described *Hevea camporum. Hevea camporum*, a small bushy treelet collected by R. Monteiro da Costa in the open granitic savannah country between the upper courses of the Rios Marmellos and Manicoré, right affluents of the Rio Madeira in Brazil, is remarkable because of the extreme reduction in the size of all of its parts. Like *Hevea minor*, it has been known through a single specimen which is in fruit. In 1945 and again in 1948, I attempted to reach the distant "campos" at the headwaters of the Rio Marmellos to study this concept in the field during its supposed flowering period, to introduce living material into experimental nurseries, and to make herbarium specimens for study and authentication. The first trip failed, due to lack of water in the headwaters of the Marmellos; the second, due to beri-beri. A very close study of the type which is preserved in the Herbarium at the Jardim Botânico in Rio de Janeiro, convinces me that, even lacking flowering material, we are safe in referring *Hevea* *camporum* to the *H. pauciflora* complex. It certainly is not referable to *H. pauciflora* itself, and it would seem to be only very slightly more reduced in size than many normal individuals of *H. pauciflora* var. *coriacea.* Whether or not it may properly be called a *forma* of this concept must await further study, and, for this reason, I have placed *Hevea camporum* in synonymy under *H. pauciflora* var. *coriacea* with some reservation. The whole appearance of the leaflets (especially their glandular-calloused tips, which, as Seibert (in Ann. Mo. Bot. Gard. 34 (1947) 278) has convincingly demonstrated, are found only in *Hevea pauciflora*), of the tiny seeds, and of the valves of the capsule is strikingly like that of many individuals of *Hevea pauciflora* var. *coriacea.*

Interest was reawakened in *Hevea camporum* with the recent discovery, on flat-topped sandstone mountain savannahs in Amazonian Colombia, of another dwarf representative of *Hevea.* This Colombian treelet—*Hevea nitida* Mueller-Argoviensis var. *toxicodendroides* (Schultes & Vinton) Schultes, described as *Hevea viridis* Huber var. *toxicodendroides* Schultes & Vinton (in Caldasia 3 (1944) 25)—was shown to be specifically indistinguishable from *Hevea nitida* which, although usually a medium-sized caatinga-tree, may become a large forest tree in some regions (Schultes in Bot. Mus. Leafl. Harvard Univ. 12 (1945) 11). In 1945, I discussed (in Rev. Acad. Col. Ciénc. Exact. Físico-Quím. Nat. 6 (1945) 336) the superficial habitat resemblance between *Hevea camporum* and *H. nitida* var. *toxicodendroides* and quoted Dr. Adolpho Ducke who, in a letter dated May 5, 1945, had written to me: "I am inclined to think that *H. camporum* would eventually be (considered) a dwarf form of *H. pauciflora* var. *coriacea,* as your *toxicodendroides* is of the typical *viridis.* The leaves of *camporum* resemble small leaves of *pauciflora* var. *coriacea.*" Ducke (in Bol.

Técn. Inst. Agron. Norte no. 10 (1946) 19) himself published this opinion. Baldwin likewise had arrived at a similar conclusion, stating (in Journ. Hered. 38 (1947) 59): "And it is my opinion that *H. camporum* . . . will be found to have the same relation to *H. confusa* that var. *toxicodendroides* does to *H. viridis*, they perhaps being ecotypes and nothing more.

Another concept which I am referring to *Hevea pauciflora* var. *coriacea* is *H. humilior*, described by Ducke in 1929 on the basis of small trees found growing on the outskirts of Iquitos, Perú. Since that time, Ducke, Baldwin, and Seibert have visited the region and have studied individuals of this concept. I have made four visits to what I believe to be the same colony of trees from which the type came (in a swampy pasture near the cemetery on the Morona-Cocha road) and have given much thought to the possible relationship of *Hevea humilior* to very similar individuals of *H. pauciflora* var. *coriacea* which I have seen near Leticia on the Río Amazonas and in the upper Rio Negro basin. I have come to the conclusion that *Hevea pauciflora* var. *coriacea* and *H. humilior* belong to the same concept.

Ducke (in Bol. Técn. Inst. Agron. Norte no. 10 (1946) 17) was the first to point this out, after he had revisited the type locality in 1945, and had restudied the problem in the light of knowledge he had gained in his experience with *Hevea pauciflora* var. *coriacea* in the Rio Negro. He wrote: [translated] "Trees of very low stature which were found on the outskirts of that city furnished me nineteen years ago with botanical material which served to create the supposed species *humilior* which I am now obliged to extinguish because it does not present a single character to separate it from *pauciflora* var. *coriacea* of the Solimões and Rio Negro."

In 1947, Baldwin stated: "In the marshes around

Iquitos, Perú, is what I consider to be a hybrid swarm of *Hevea confusa*×*H. guianensis* . . . . From that population at Iquitos, Ule described *H. paludosa*, and Ducke named *H. humilior*. The plants are doubtless extracts from a hybrid swarm, with strong resemblance to *H. confusa*.''

In his study of the genus *Hevea* in Perú, Seibert (l.c. 302) discussed *H. humilior* in detail: ''The type material, in both species [*H. humilior* and *H. paludosa*] is thought to represent segregating material from an hybrid swarm derived through interspecific hybridization of *H. pauciflora* and *H. guianensis* var. *lutea*. In both *H. paludosa* and *H. humilior* the material most closely simulates *H. pauciflora*, and recent collections have been labeled *H. pauciflora* var. *coriacea* by Ducke. The presence of *H. guianensis* var. *lutea* is morphologically more difficult to distinguish in the types of *H. humilior* than in *H. paludosa;* but, at least through bud acumination and pubescence characters, there can be little doubt of its presence.

''If *H. pauciflora* and *H. guianensis* var. *lutea* were the only species concerned in producing the Iquitos hybrid swarm the problem would be relatively simple. The swarm is complicated in that segregates of *H. pauciflora* ×*brasiliensis* also appear. Morphological evidence from the leaves, short-shoots, bud acumination and contortion, calyx-lobe acumination, and seed characters can leave little doubt of such a condition existing.

''. . . The Iquitos hybrid swarm complex is still insufficiently known and collected to give more than faint, inconclusive evidence that certain specimens show influence of all three species within the same plant.'' In furtherance of his study of these Iquitos trees, Seibert appends (l.c. 317) a scholarly and original analysis of the material available.

Hybridization is probably of relatively common occurrence in areas like Iquitos, where man has greatly disturbed the natural habitat. Nevertheless, the role of hybridization in altering the trees which have been called *Hevea humilior* may have been exaggerated. Furthermore, these trees do not depart from *Hevea pauciflora* var. *coriacea,* in its broad sense, to such an extent as has been suggested.

Hevea pauciflora var. *coriacea,* as I understand it, embraces the material from the Guianas (*H. confusa*), from the widely spread localities of the great Rio Negro valley, from the Solimoes and Japurá, from Iquitos (*H. humilior*), and probably also from the Marmellos (*H. camporum*); it is certainly one of the most variable concepts of the genus, but I think that it is a concept enjoying a fundamental biological homogeneousness. The material of *Hevea humilior* from Iquitos, like that which I have collected near Leticia (Colombia) and which several workers have gathered at São Paulo de Olivença, is, indeed, different from the more northern representatives, but I am in agreement with Ducke that it can be referred, without any reservation, to *H. pauciflora* var. *coriacea.* Later, we may possibly find that *Hevea humilior* as well as *H. camporum* should be accommodated within *H. pauciflora* var. *coriacea* in the rank of *forma,* through the use of a trinomial, but such a step must await further morphological studies for final settlement. Since these present notes are not primarily taxonomic, but are meant to be chiefly nomenclatural, I do not propose to discuss the minor variations and differences at this time, nor do I intend to consider here the suggestions which Baldwin and Seibert have made concerning the genetic makeup of the concept. These topics will be deferred for consideration in a general biological study of the taxonomy, morphology, and phytogeography of the *Hevea pauciflora* complex.

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ERRATA

page 15, line 31
for hunc, read hoc

page 45, line 18 through page 49, line 17 (**Senefelderopsis** et seq.)
insert on page 43, line 17 following *Sapium Aubletianum*

page 94, line 16
for genus, read subgenus

page 95, line 33
insert No. after Mus.

page 99, line 31
for ones, read one

page 138, line 6
for *serapo*, read *sarapo*

page 182, line 5
for refer, to, read refer to,

page 190, line 1
for Spruceanum, read Spruceanus

page 198, line 25
for carboniferous, read Carboniferous

explanation of Plate LXI, line 3
for *endrocentrica*, read *endocentrica*

page 211, line 11
for *crassipes*, read *Sprucei*

page 223, line 17
for A. V., read Alfred

page 228, line 12
for tuff, read tuft

page 231, line 15
for glume, read glumes

page 240, line 5
for *Chrysoma*, read *Chrysomya*

page 252, line 4
for abrubt, read abrupt

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